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Polydioxane (PDS) cord has insufficient reliability to securely close the sternum

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Median sternotomy is a common approach to expose the heart for cardiac surgery. The sternum is usually closed with stainless wires or thick-braided sutures after surgery. We have used Polydioxane (PDS) cord sutures 1.0 mm in diameter for closing the sternum on 350 patients for the last one and a half year. But recently, three patients suffered broken PDS sutures and instability of the sternum several weeks after surgery. The sternum had to be closed immediately in two of them after the broken sutures because of wound dehiscence. One patient was observed closely without surgical intervention because of renal failure and MRSE carrier on skin culture.

Cases

All three patients had some risk factors for wound healing. One was a 73 -year-old man, who suffered an old myocardial infarction with poor left ventricle function, chronic atrial fibrillation and diabetes mellitus. He underwent on-pump 4-vessel aorto-coronary bypass grafting concomitant with Maze procedure. He suffered a minor stroke and required long mechanical ventilation therapy and tracheostomy on the 10^{th} postoperative day. Sternum instability was observed on the 12^{th} postoperative day after bronchoscopy. He revealed wound dehiscence on the 14^{th} day and sternum re-closure was performed on the same day. All 6 PDS cord sutures were broken beside the knot without any loose ligation or broken sternum.

One was a 75-year-old man with aortic arch aneurysm and angina pectoris. He had chronic obstructive pulmonary dysfunction and severe obesity. Total arch replacement was performed under hypothermic circulatory arrest concomitant with aorto-coronary bypass grafting. He was extubated on the second postoperative day and discharged from the intensive care unit on the third postoperative day. Sternal instability was revealed on the 7^{th} postoperative day and wound dehiscence on the 9^{th} postoperative day. Reclosure of the sternum was performed on the 10^{th} postoperative day. Only the lower part of the sternum was broken, but all 6 PDS code sutures were broken without loose knot.

The last was a 68-year-old woman with angina pectoris. She had a history of atrial septal defect closure via right thoracotomy at 31 years of age. The case was complicated with asthma, diabetes mellitus and renal failure. Off pump 3 vessels coronary bypass grafting was performed. She was extubated on the next day and recovered well. But sternal instability occurred during an asthma attack on the 10^{th} postoperative day with a cracking sound. Her chest CT revealed a separation of several cm throughout the sternum. She was followed without sternal reclosure because she had no wound dehiscence, suffered from renal failure and MRSE carrier on her skin.

Macroscopic Finding

The broken PDS cord sutures of case 1 were carefully examined. All six PDS cords had completely snapped. Two of them were placed in the sternum manubrium and the other 4 were located just around the sternum body at the intercostal space. No loose knots were observed. Broken sites were 3 to 15 mm apart from the knot. The cord stumps gradually became thin, kinked with curled filaments and possibly had been torn off (Figures 1 and 2). Twenty mm away from the broken end on 2 of them, what appeared to be abrasion injures were observed. On the sternum manubrium where the cord protruded, the cord was thought to have been abraded on the edge of the bone.

Discussion

PDS cord suture is designed to close the sternum. It has enough strength for traction force, but it may be damaged by shear stress with a bone edge. The damaged part of the suture loses strength and may break under severe traction due to coughing or bronchial suction. Macroscopic findings of broken sutures indicated abrasion injury due to friction with the bone edge or that they were torn off under severe traction.

PDS cord is a synthetic absorbable suture. PDS cord of 1.0 mm in diameter has sufficient tensile strength (180 N) for closing the sternum before use. But it decreases gradually after use in the body. Manufacturer data show the tensile strength of 50-65% at 3

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Figure 1. Low magnified image of broken PDS suture (×5). No loose knot was observed. Broken sites were 3 mm apart from the knot. Another abrasion injury was observed 20 mm away from the broken site. One is the part of the cord just above the sternum, and the other is the part just below the sternum.

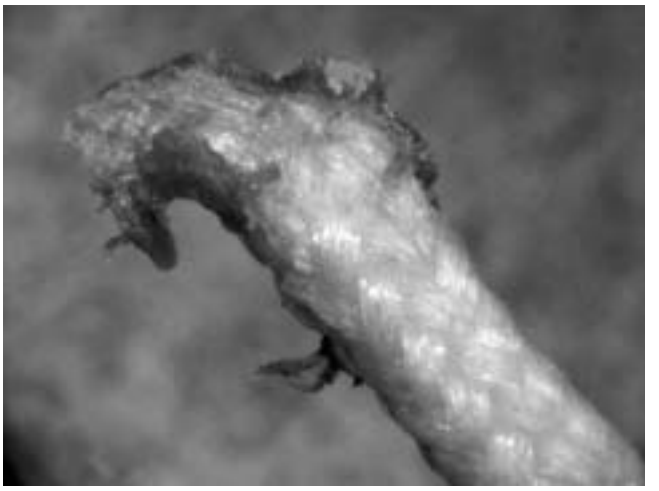

Figure 2. Magnified image of site of break (a) (×60). The cord stump gradually became thin, kinked with curled filaments, and had possibly been torn off.

weeks and 30-40% at 6 weeks after implantation. This is another reason for broken sutures.

Broken sutures made of PDS cord may occur several weeks after surgery when patients have a persistent cough. PDS cord sutures do not have sufficient reliability to close the sternum, especially in patients with chronic obstructive pulmonary dysfunction and obesity.[1]

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Intraoperative finding of structural abnormality of bovine pericardial aortic prosthesis

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The bovine pericardial valve is an excellent valve, with a long, widespread use without reported intraoperative failures.[1] However, 4 intraoperative structural failures of bovine pericardial bioprostheses placed in the mitral position were recently reported.[2] The authors of this report hypothesized that the failures were caused by the distortion of the normal planar geometry of the prosthesis caused by mitral annular disease; this leads to failure of adequate central leaflet position and coaptation.

We report the intraoperative finding of a structural abnormality of the same type of bovine pericardial valve, detected after implantation in the aortic position, before closure of the aorta.

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Clinical Case

A 69-year-old man underwent elective operation for aortic valve stenosis and dilatation of the ascending aorta. His heart had a poor global functionality, with an echocardiographic ejection fraction of 20% to 25%. The operative approach was through median sternotomy; the ascending aorta appeared dilatated starting from the sinotubular junction up to 1.5 cm before the origin of the innominate artery. The Valsalva sinus and aortic arch appeared slightly dilated, and cardiomegaly (mainly for dilatation of the left ventricle) was observed. We opted for separate replacement of the aortic